Enhanced Water Quality Monitoring and Modeling Program for the A.R.M. Loxahatchee National Wildlife Refuge Quarterly Update Report – March 2016

Prepared by:
Donatto Surratt, A.R.M. Loxahatchee National Wildlife Refuge

Overview

This update is a summary of activities since the previous status report of December 2015 on the implementation of the Refuge's Enhanced Water Quality Monitoring and Modeling Program. A project overview, and other detailed information about the program can be found at: http://sofia.usgs.gov/lox_monitor_model/. The primary objective of this overall program (Brandt et al. 2004) focuses on providing information for use in ecological management of the Refuge (e.g., USFWS 2007a, b; USFWS 2009; USFWS 2010a, b; USFWS 2012a; USFWS 2012b; USFWS 2013; USFWS 2014; USFWS 2015).

The Refuge's monitoring component of this program also addresses one of the Consent Decree Principals recommendations (17 December 2003):

> ***B. Enhancing Monitoring of the Refuge***
> *Design and implement an enhanced monitoring program to improve spatial and temporal understanding of factors related to phosphorus dynamics.*

Information Availability

Through collaboration with USGS, information from the Refuge's Enhanced Water Quality Monitoring and Modeling Program has been made available on the USGS' SOFIA web site at: http://sofia.usgs.gov/lox_monitor_model/.

Final data for monthly samples through May 2006 are publicly posted on DBHYDRO by the SFWMD at http://my.sfwmd.gov/dbhydroplsql/show_dbkey_info.main_page. Data for June 2006-March 2016 are posted on the Technical Oversight Committee's web site at http://www.sfwmd.gov/toc/. This report includes information from samples collected through March 2016.

Water Quality Data Analyses Update

Primary efforts for this quarter involved exploring mechanisms to continue translating information from the program to aid in Refuge management decisions, and working on the program's Annual Report.

Monitoring Update (January – March 2016)

Sampling of the enhanced water quality monitoring network (**Figure 1**) occurred at 37 stations in January, 37 in February, and 37 in March 2016 (**Table 1**).

Total phosphorus data available to date for April 2015 through March 2016 are presented in **Table 1**. Maps of stations where samples were collected for the months from January through March 2016 are presented in **Figures 2-4**.

Conductivity sonde deployment information for April 2015 through March 2016 is presented in **Table 2**.

Next Steps

The next steps for this program include additional efforts on the Annual Report.

References

Brandt, L.A., Harwell, M., Waldon, M. (2004) Work Plan: Water Quality Monitoring and Modeling for the A.R.M. Loxahatchee National Wildlife Refuge: 2004-2006. Prepared for the A.R.M. Loxahatchee National Wildlife Refuge. April, 2004. 33 pp.

USFWS. (2007a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Monitoring and Modeling Program – 2nd Annual Report – February 2007. LOXA06-008, U.S. Fish and Wildlife Service, Boynton Beach, FL. 183 pp.

USFWS. (2007b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 3rd Annual Report – October 2007. LOXA07-005, U.S. Fish and Wildlife Service, Boynton Beach, FL. 116 pp.

USFWS. (2009) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 4th Annual Report – July 2009. LOXA09-007, U.S. Fish and Wildlife Service, Boynton Beach, FL. 106 pp.

USFWS. (2010a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 5th Annual Report – September 2010. LOXA08-007, U.S. Fish and Wildlife Service, Boynton Beach, FL. 43 pp.

USFWS. (2010b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 6th Annual Report – October 2010. LOXA09-011, U.S. Fish and Wildlife Service, Boynton Beach, FL. 42 pp.

USFWS. (2012a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 7th Annual Report – February 2012. LOXA12-001, U.S. Fish and Wildlife Service, Boynton Beach, FL. 115 pp.

USFWS. (2012b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 8th Annual Report – October 2012. LOXA12-004, U.S. Fish and Wildlife Service, Boynton Beach, FL. 68 pp.

USFWS. (2013) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 9th Annual Report – June 2013. LOXA13-001, U.S. Fish and Wildlife Service, Boynton Beach, FL. 71 pp.

USFWS (2014) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Program – 10th Annual Report for calendar year 2013 – June 2014. LOXA14-002, U.S. Fish and Wildlife Service, Boynton Beach, FL. 71 pp.

USFWS (2015) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Program – 11th Annual Report for calendar year 2014 – June 2015. LOXA15-002, U.S. Fish and Wildlife Service, Boynton Beach, FL. 81 pp.

Table 1. Total phosphorus data (ppb) available for April 2015 – March 2016 from the Enhanced Water Quality Monitoring Program for: (a) marsh, and (b) canal stations for the A.R.M. Loxahatchee National Wildlife Refuge. Graphical representation of station locations are shown in Figure 1.

a) Marsh stations

Marsh Station	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16
LOXA101	-	-	-	-	-	46	17	19	11	11	8	11
LOXA102	-	-	-	-	-	32	14	10	10	8	8	10
LOXA103	-	-	-	-	-	28	15	10	13	9	10	10
LOXA105	6	-	-	-	-	44	23	22	13	13	9	13
LOXA106	-	-	-	-	-	24	14	13	9	10	6	9
LOXA107	-	-	-	-	-	13	12	11	10	10	6	11
LOXA108	-	-	-	-	-	12	9	8	5	6	6	9
LOXA109	6	-	-	-	12	13	13	9	8	11	7	9
LOXA110	5	-	-	-	4	13	6	10	5	7	6	6
LOXA111	-	-	-	-	-	19	8	10	9	12	7	10
LOXA112	5	-	-	-	-	14	13	10	6	9	6	6
LOXA113	7	-	-	-	-	14	11	9	8	6	8	9
LOXA114	8	12	13	-	-	13	10	9	11	7	7	8
LOXA117	9	-	-	-	-	25	20	13	10	14	4	12
LOXA118	13	-	-	-	-	15	16	10	11	10	4	10
LOXA119	5	15	-	-	15	11	12	7	5	7	5	7
LOXA120	6	16	23	-	11	10	8	10	8	6	4	8
LOXA122	12	-	-	-	-	18	22	17	12	13	6	12
LOXA124	-	-	-	-	-	50	19	24	33	20	14	20
LOXA126	U	15	-	-	9	13	12	9	9	8	4	6
LOXA127	5	9	-	-	15	10	11	8	9	6	3	7
LOXA128	5	-	-	-	-	11	8	7	8	4	5	9
LOXA130	69	13	25	-	14	23	13	8	12	11	8	8
LOXA131	8	6	13	-	8	13	11	7	8	11	7	8
LOXA133	12	-	-	-	36	29	22	14	18	14	10	9
LOXA134	8	10	-	-	17	16	14	7	12	13	9	8
LOXA136	61	-	-	-	-	32	20	14	12	13	13	10
LOXA137	6	-	-	-	-	19	14	10	9	12	7	9
LOXA138	16	-	-	-	-	17	11	6	6	13	7	7
LOXA139	12	-	-	-	-	12	12	11	8	9	9	6
LOXA140	-	-	-	-	-	21	14	9	8	11	11	9
LOXA141	9	42	17	-	17	13	16	5	9	7	20	18
MAX	69	42	25	0	36	50	23	24	33	20	20	20
MIN	5	6	13	0	4	10	6	5	5	4	3	6

U indicates that compound was analyzed, but the concentration was below the minimum detection limit.

Table 1 cont.

b) Canal stations

Canal Station	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16
LOXA104	25	26	18	25	20	24	27	20	18	19	19	19
LOXA115	18	20	22	15	18	27	28	16	20	19	50	20
LOXA129	18	23	20	17	51	17	13	19	14	20	36	21
LOXA132	20	22	24	16	42	19	15	17	15	18	63	19
LOXA135	20	18	21	18	25	17	18	14	16	18	68	23
MAX	25	26	24	25	51	27	28	20	20	20	68	23
MIN	18	18	18	15	18	17	13	14	14	18	19	19

U indicates that compound was analyzed, but the concentration was below the minimum detection limit.

Table 2. April 2015 – March 2016 conductivity sonde deployment information, separated by transect, for the A.R.M. Loxahatchee National Wildlife Refuge. X = data collected from sonde deployment during that month. Graphical representation of station locations are shown in Figure 1.

	2015									2016			
Site ID	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
LOXA104		X		X	X		X	X		X		X	X
LOXA105		X		X		X	X		X		X		X
LOXA106		X		X		X	X		X		X		X
LOXA107		X		X		X	X		X		X		X
LOXA108		X		X		X	X		X		X		X
LOXA115	X	X		X			X	X		X		X	
LOXA116		X			X	X	X		X		X		X
LOXA117		X		X		X	X		X		X		X
LOXA118		X		X		X	X		X		X		X
LOXA119		X		X		X	X		X		X		X
LOXA120		X		X		X	X		X		X		X
LOXA129	X	X		X	X		X	X		X		X	X
LOXA130			X	X		X	X		X		X		X
LOXA131			X	X		X	X		X		X		X
LOXA132	X	X			X	X	X			X		X	X
LOXA133			X		X		X		X		X		X
LOXA135	X	X		X	X		X	X		X		X	X
LOXA136			X		X		X		X		X		X
LOXA137			X	X		X	X		X		X		X
LOXA138			X	X		X	X		X		X		X
LOXA139			X	X		X	X		X		X		X
LOXA142	X	X			X			X		X			X
LOXA143	X			X			X			X		X	
LOXA144	X			X			X			X		X	
LOXA145	X			X			X			X		X	
LOXA146	X			X			X			X		X	
LOXA147	X	X	X	X		X			X		X		X
LOXA148	X		X		X		X		X			X	
LOXA149	X		X		X		X		X			X	
LOXA150	X		X		X		X		X			X	
LOXA151	X	X		X	X		X	X		X			X
LOXA152	X	X		X	X		X	X		X		X	X
LOXA153	X	X		X	X		X	X		X			X
I-8C	X	X	X	X	X			X		X		X	
LOX04			X	X		X	X		X		X		X
LOX15	X		X		X		X		X			X	

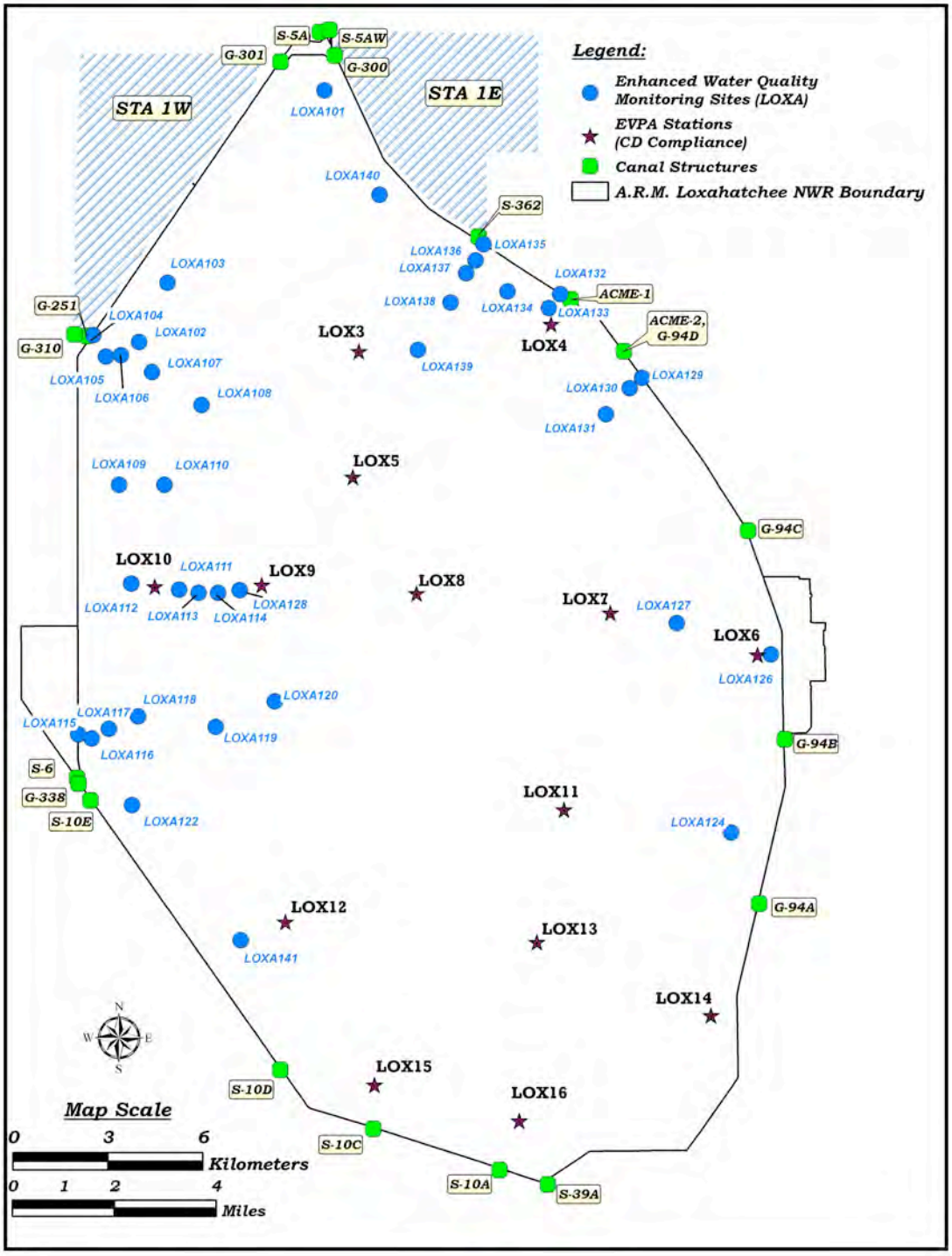

Figure 1. Location of Enhanced Water Quality Monitoring network stations (LOXA###), in relation to Consent Decree compliance stations (LOX##), for the A.R.M. Loxahatchee National Wildlife Refuge.

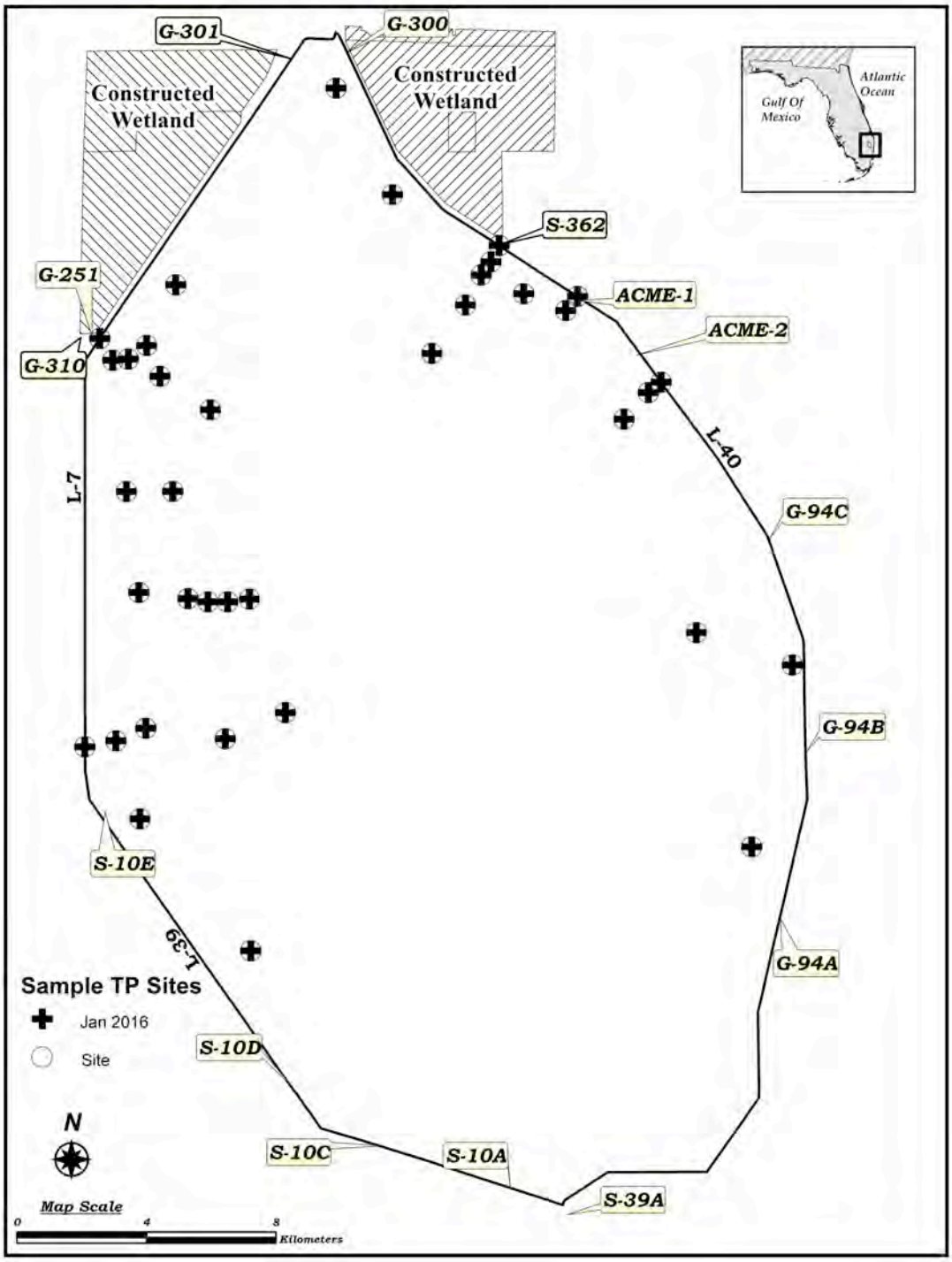

Figure 2. January 2016 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

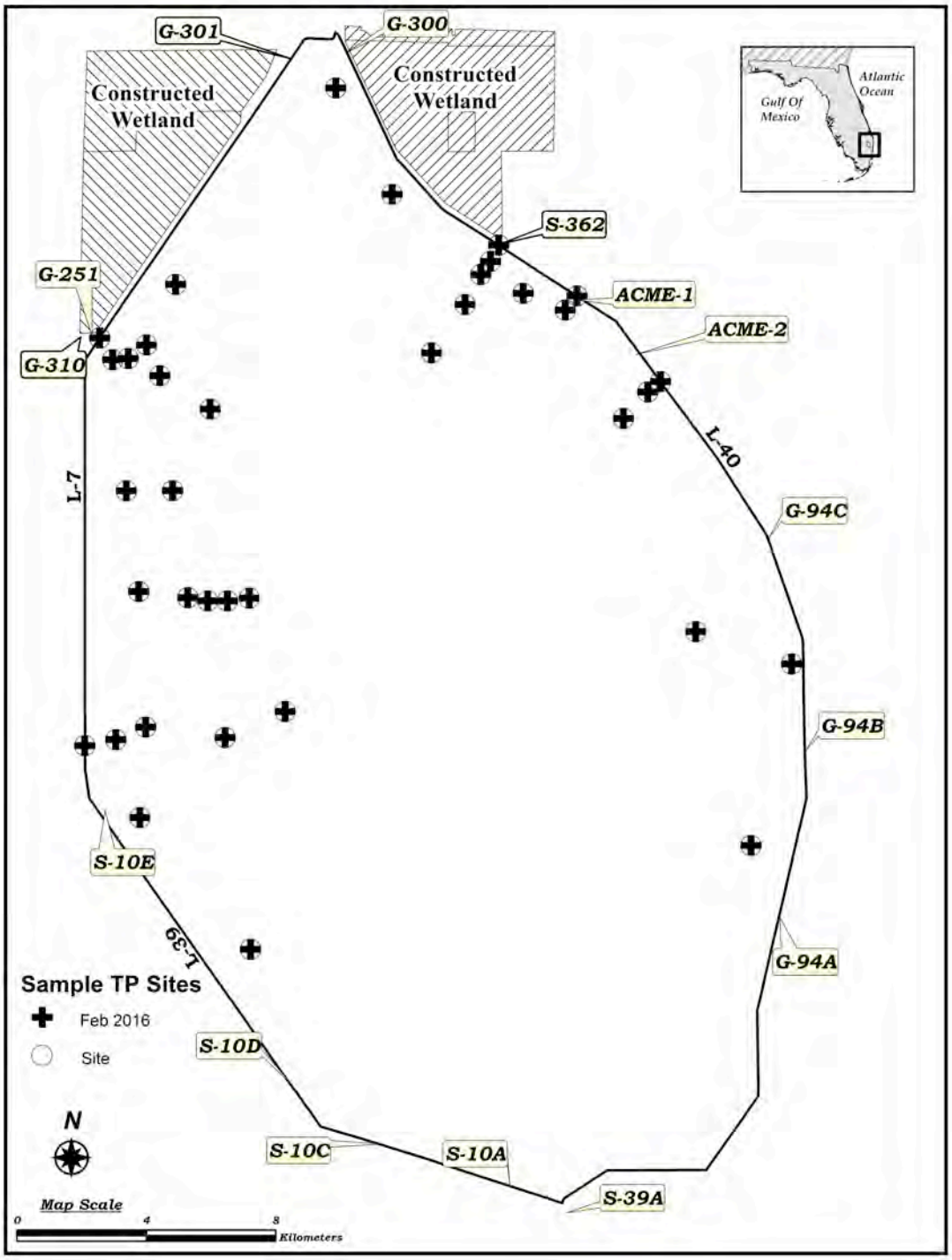

Figure 3. February 2016 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

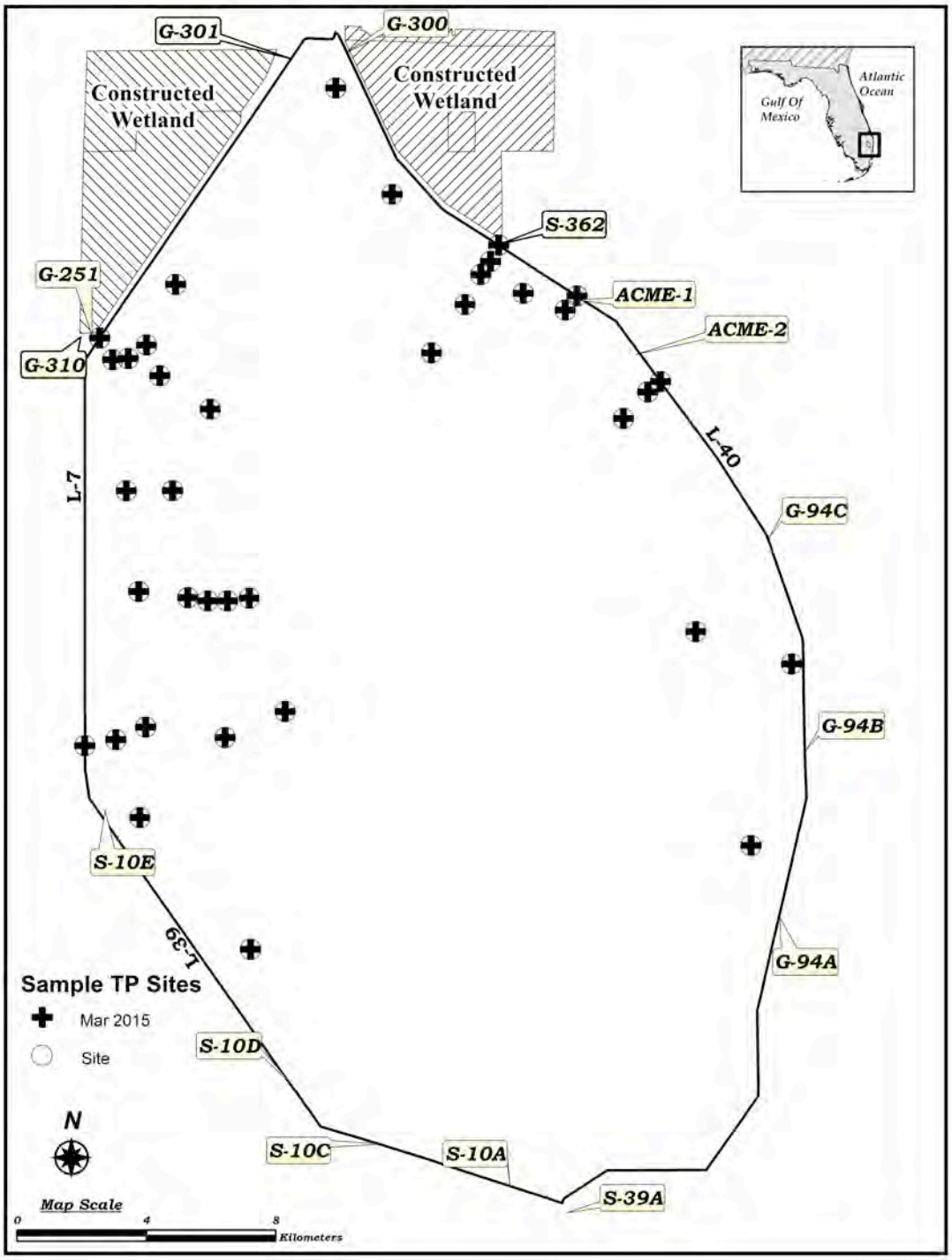

Figure 4. March 2016 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.